REMARKS

Claims 1-6 and 11-17 are pending in this application, with claims 4-5 and 11 being withdrawn from consideration. By this Amendment, the specification and claims 1, 11-12, and 15-17 are amended. No new matter is added.

Entry of the amendments is proper under 37 CFR §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration as the amendments amplify issues previously discussed throughout prosecution or address issues raised for the first time subsequent to this Office Action; (c) satisfy a requirement of form asserted in the previous Office Action; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection and during the subsequent April 27 interview. Entry of the amendments is thus respectfully requested.

The courtesies extended to Applicant's representative by Examiner Rodriguez during the telephone interview held April 27, are appreciated. The reasons presented at the interview as warranting favorable action are incorporated into the remarks below and constitute Applicant's record of the interview.

I. Pending Claims Define Patentable Subject Matter

The Office Action rejects the claims under 35 U.S.C. §101 alleging that the claimed invention is inoperative and therefore lacks utility. The Office Action further rejects claims 1-3, 6, and 12-17 under 35 U.S.C. §112, first paragraph, alleging that the claims are not enabled. Applicant respectfully traverses these rejections.

The Office Action alleges that one passage of the specification is believed to be inoperative and thus fails to provide enablement or utility. In particular, it is alleged that Applicant is violating basic principles of thermodynamics and fluid mechanics by stating that

"in this section 1510, the exiting gases further expand and develop high pressure and temperature ever continuously." The Patent Office's reasoning is that no high pressure or high temperature can develop "because there is no additional heat being added into this section." However, as discussed and agreed to during the April 27 telephone interview, Applicant respectfully disagrees because the Office Action fails to appreciate the provision of external heating elements 1280 provided within section 1510 (Figs. 2 and 4 and paragraphs **[0037]** - **[0043]**), which do provide additional heat.[1]

The fluid dynamic principles set forth in the textbook attachments to the Office Action do set forth that for a converging nozzle the pressure and temperature decreases. However, these equations assume an isentropic airflow (no change in entropy) in which no additional work is provided to the mass. Applicant does not violate this principle because of the additional presence of heating elements 1280 on the walls of region 1510. These heated walls provide external heat to the air or steam mass, which causes further gas expansion and thus results in the recited increase in pressure and temperature. Thus, the formulas relied upon in the Examiner's textbook examples do not apply and are not violated.

As discussed and agreed to during the interview, Applicant revises the specification to clarify the presence and function of the heating elements 1280. No new matter is added because Figs. 2 and 4 clearly show the heating elements 1280, which are described elsewhere in paragraphs **[0037]** - **[0043]**.

As also discussed, Applicant is not claiming a perpetual motion machine. To avoid possible confusion, the objectionable "ever continuously" passage is omitted.

[1] As indicated during the interview, although Applicant elected the Fig. 4 embodiment, paragraph **[0048]** states that the Fig. 4 embodiment is "otherwise the same as Fig. 2." Thus, aspects of the heating elements 1280 found in Fig. 2 and on paragraphs **[0037]** - **[0043]** also apply to Fig. 4.

Because the only objectionable aspect of the invention has been clarified and it has been agreed to by the Examiner that because of the presence of heating elements 1280 natural laws are not violated, it is respectfully submitted that the outstanding rejections based on §101 and §112 are overcome. Withdrawal of the rejections is respectfully requested.

II. Request for Working Model is Not Needed and Unduly Burdensome

The Office Action requests a working model of the invention. As discussed during the interview, the §101 rejection was based on an improper understanding of the invention that overlooked operation of the heating elements 1280. Because it is agreed upon that natural laws are not violated by the invention, there is no longer any need for a working model because a proper understanding of the invention can be gleaned from Applicant's specification, which forms a constructive reduction to practice of the invention. Thus, the requirement for a working model will be <u>withdrawn</u> as agreed upon during the April 27 telephone interview.

Moreover, Applicant, a private inventor, wishes to again point out the severe burden and impracticality of providing the Patent Office with a working model of a jet engine, compressor, chilling mechanism, and exhaust. Beyond the huge expense needed to fabricate and build an actual device is the impracticality of shipping the device to and receiving such a large scale device at the Patent Office. Although a scale "model" might be built, it is unlikely that any practical "model scale" would be operable as compressors, combustion chambers, coolers, etc. that operate properly must have significant size and weight. Further, to demonstrate operability would require a test stand that could withstand any forces generated by this jet engine, something it is not believed is present in the Patent Offices.

Thus, it is believed to be more efficient for all parties concerned that operability is demonstrated through rebuttal argument as provided.

III. Subsequent Questions From the Examiner

Although not specifically raised in the Office Action, Examiner Rodriguez raised some additional issues for the first time during the telephone interview. Because these were not previously raised by the Examiner prior to final rejection and were not necessitated by amendment, the finality must be withdrawn to consider these issues and give Applicant an opportunity to further respond, if necessary. Although not formally of record, to further prosecution, Applicant will also respond to these questions.

A. Temperature of Materials

It was questioned whether the invention was capable of operating at the extreme disclosed operating temperature of 3500°C. Applicant advised Examiner Rodriquez that this was a non-critical and non-claimed maximum possible temperature and that the lower ranges of the disclosure were clearly enabled. Moreover, one of ordinary skill in the art would follow standard practices and operate the device within design criteria of the materials that are selected or available. In this regard, various high temperature materials were available at the time of Applicant's filing that could meet at least much or all of the range, particularly the claim ranges of "200-400°C" and "at least 1000°C." For example, the enclosed Ceramight™ article states that Ceramight™ is commercially available for use in rocket propulsion systems and can withstand high temperatures of at least 5,000°F (2,760° C). Additionally, the enclosed Tungsten article establishes that as early as 1972 Tungsten was used to manufacture high temperature alloys for use on jet engines and missiles and has a melting temperature of at least 3410° C.

Thus, because the claimed ranges are clearly conventional and attainable, Applicant respectfully submits that this possible objection is moot. Moreover, no undue experimentation would be necessary because the heaters 1280 could be controlled to operate within the parameters of the materials selected.

B. "Combustion" Chamber

Examiner Rodriguez pointed out that the claims include a "combustion" chamber but the elected Fig. 4 embodiment does not include any combustible materials, but instead operates on expansion of steam or air for propulsion.

Although Applicant can be his own lexicographer and can and has given the term a special meaning when read in light of the specification, the claims are revised for clarity to address the Examiner's concerns by referring to the chambers as "propulsion expansion" chambers. This is consistent with all embodiments, which rely on an expansion of a gas to achieve propulsion and may include use of various propulsion sources, including combustible fuels. Thus, no new matter is added.

C. Propulsion and Electricity Generation

Examiner Rodriguez also indicated that the Fig. 4 embodiment includes turbines 3400 that are driven by gases from the propulsion. The Examiner wanted to know how the system can provide both electrical generation and propulsive thrust.

As clearly shown in Fig. 4, only a small portion of the gases from chamber 1510 are drawn through the turbines. The remainder of the expanding gases travel out the exhaust and serve as thrust. Because of valving 3310, the amount of gases that flow through the turbines can be controlled based on need (Applicant's paragraph **[0048]**). Thus, when less thrust is needed, more can be diverted to generate electricity from the turbines. However, when more thrust is needed, the valving can be suitably closed or reduced to meet needs or demands. Accordingly, one of ordinary skill in the art would readily recognize the operability of this propulsion system to provide thrust as well as electricity generation.

IV. Pending Claims Define Patentable Subject Matter

As discussed during the interview, Applicant acknowledges that no art rejections have been applied in either of the Office Actions. Thus, upon withdrawal of the current §101 and §112 rejections, the application should be in condition for allowance. In this regard, since the independent claims are generic to all species, Applicant requests rejoinder and allowance of withdrawn claims 4-5 and 11.

However, if additional searching is deemed necessary, Applicant submits that the finality of this Office Action is premature and should be withdrawn in order to provide Applicant an opportunity to respond as the claims have never been amended to distinguish over applied art.

V. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of pending claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Stephen P. Catlin
Registration No. 36,101

JAO:SPC/spc

Date: July 5, 2006

Attachments:
Ceramight™ Article
Tungsten Article

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

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Materials for Low and Zero Erosion Rocket Motors

Triton Systems, Inc., (Chelmsford, MA)

Summary:

Triton Systems, Inc., has spun off an affiliated company called Ceracom, Inc., to further develop and commercialize a novel BMDO SBIR-funded ceramic-metal composite (CMC) called CeramightTM. Ceramight is a heat-tolerant composite material that exhibits virtually no erosion in rocket propulsion systems. Its feasibility is being demonstrated in a number of MDA applications, such as integrated throat entrances for rocket nozzles and liquid divert attitude and control systems for Theater High Altitude Area Defense (THAAD). To this end, Triton Systems has formed numerous strategic partnerships with MDA contractors. Ceracom is also pursuing non-defense applications, in the aerospace, furnace, automotive, and tooling industries.

Technology Description:

Triton Systems has teamed with several strategic partners to further the development of a novel ceramic-metal composite (CMC) called CeramightTM. Ceramight is a composite material with high heat tolerance that exhibits virtually no erosion in rocket propulsion systems. It can be made using a variety of materials, such as fully stabilized zirconia (FSZ) and tungsten (W). Other material combinations can be used to create Ceramight materials at low cost and in batch quantities. Using Ceramight, fabricators form near-net-shaped green bodies through robust tape casting and consolidation. These green bodies are then machined to vital tolerances and sintered in a pressureless environment to form the finished, precision shapes.

A unique feature of Ceramight materials is that they retain their strength at elevated temperatures. For example, Ceramight is 10 times stronger than columbium at 2,350oF, 20 times stronger than W at 4,000oF, and retains its full strength at operating temperatures above 5,000oF. Additionally, because of its unique microstructure and the fact that it is a ceramic/metal hybrid, its fracture toughness is greater than that of

ceramic alone. For example Ceramight ZrC/W has a fracture toughness that is more than three times that of silicon carbide and does not oxidize or erode during liquid and solid rocket motor nozzle/chamber tests. Finally, important to both defense and the commercial sector, manufactured components have been shown to cost 1/10th to 1/250th of the price of refractory components produced using similar manufacturing methods. This reduced cost is because the Ceramight process uses low-cost starting materials and produces near-net-shape green body parts, which require less machining.

Triton has so far produced Ceramight materials using fully stabilized zirconia (FSZ)/tungsten (W), FSZ/molybdenum (Mo), hafnium oxide (HfOx)/W, HfOx/FSZ/Mo, HfO_2/TaC (tantalum carbide)/W, and TaC/W.

BMD Origins:

Triton was funded through a Phase II BMDO SBIR contract in 2001 to further the development of Ceramight materials. The company is demonstrating the feasibility of using Ceramight materials in a number of MDA applications, such as integrated throat entrances (through Pratt and Whitney's Chemical Systems Division and Thiokol), liquid divert attitude and control systems (DACS - through Rocketdyne for Theater High Altitude Area Defense [THAAD]) and solid DACS (through Thiokol).

Spinoff Applications:

Ceramight can serve as a low-cost, high-performance alternative in any defense or commercial application where the ability to withstand harsh, high temperature environments is an issue. Ceramight materials can be used to make components such as thermal shields and thrust chambers used in the aerospace industry. They also have applications in the furnace, automotive, and tooling industries.

Commercialization:

On August 1, 2001, Triton spun off an affiliated company, called Ceracom, Inc., to commercialize this technology. The company has several teaming partners including Pratt and Whitney, Chemical Systems Division; Rocketdyne; Atlantic Research Corporation; General Dynamics; Thiokol; and Aerojet. For non-missile defense applications, Ceracom is working with Rocketdyne and General Dynamics to identify private sector commercial products for space propulsion.

The Ceracom team is focused on developing additional industrial manufacturing capability to commercialize products in the market sectors of space, rockets, turbine engines, aerospace, and industrial products. The new company has 14 employees and is currently co-located at Triton Systems, but has developed plans for expanding its manufacturing facilities near Chelmsford to a 40,000 ft2 facility. Ceramight is patented both domestically and internationally and the rights have been transferred from Triton Systems to Ceracom. Triton Systems, however, still holds the BMDO SBIR contract. An Israel-based venture firm, Millennium Materials Technologies, also has a position in Ceramight technology.

Company Profile:

Triton Systems, Inc., is a materials product and process development firm with roughly 100 employees dedicated to creating innovative products in emerging materials markets. The company is privately owned and has grown at 45 percent annually since its founding in 1992. It recently launched three spinoff companies

(Elecon, Inc., Sensera, Inc., and TriBond, Inc.), in which the Millennium Materials Technologies Venture Fund took a lead investor position. These spinoff companies are based on SBIR-funded research, including one from another BMDO SBIR contract.

Contact Information: Dr. Frederick Lauten, Technology Development
Dr. Dave Marchant, Manufacturing Development
Dr. John Garnier, Business Development
Triton Systems, Inc. and Ceracom Inc.
200 Turnpike Road
Chelmsford, MA 01824
Tel: (978) 250-4200
Fax: (978) 250-4533
E-mail: Flauten@tritonsys.com
Dmarchant@ceracominc.com
Jgarnier@ceracominc.com
Web: www.tritonsys.com

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Note: The Ballistic Missile Defense Organization (BMDO) and the Strategic Defense Initiative Organization (SDIO) are predecessors of the Missile Defense Agency (MDA).

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TUNGSTEN (*tŭng'stĕn*) is a heavy steel-gray o silver-white metal. It does not rust, and it extremely hard. Its melting point is 3,410 grees Centigrade (6,170 Fahrenheit), the high- of any metal. *Tungsten*, a Swodish word, eans "heavy stono." It was discovered in 783 by the Spanish mineralogist brothers Juan ... and Don Fausto d'Elhuyar. Its chemical symbol, W, is from wolfram, tho German name for tungsten. Its atomic number is 74, and its atomic weight is 183.85. Tungsten minerals are found mostly in the rocks of mountainous regions. Wolframite, scheelite, ferberite, and hubnerite are the chief tungsten minerals. The primary source areas are located in China, Burma, Korea, Bolivia, Brazil, Portugal, the Soviet Union, and the United States.

In the production of tungsten, the ores are crushed and washed with water. Heavy tungsten minerals settle, and the lighter rock particles are washed out. The concentrated ore is chemically treated to produce a soluble tungsten compound. This is dissolved and leaves behind insoluble impurities. Chemical treatment continues until WO_3, or tungsten oxide, is obtained. Heating the tungsten oxide in hydrogen gas yields a puro tungsten powder at between 800 and 1,000 degrees Centigrade. Its high melting point makes it commercially impractical to melt tungsten. The powdered metal is compressed into bars in hydraulic presses. The bars are heated in electric furnaces to a temperature of 1,500 degrees Centigrade and placed in swaging, or hammering, machines. These machines pound the bars into rods of smaller diameter. The rods can be rolled or hammered into sheets, or they can be drawn through diamond dies to produce fine tungsten wire.

The most important use of tungsten is in the manufacture of tough steel alloys, which retain their hardness and strength at high temperatures. These alloys are used in jet engines, missiles, and high-speed cutting tools. Tungsten carbide, one of the hardest materials made by man, is used in place of diamonds for cutting and drilling. Puro tungsten is used primarily in the electronic and electric industries. Electrical contact points in the distributor and spark plugs of many engines are made partially of tungsten. In the national interest, the U.S. government maintains a stockpile of this valuable metal.

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